

IN THE CLAIMS

Please cancel claims 1-13, 21 and 26-35 without prejudice or disclaimer, and amend claims 14, 17, 22, 24, 25, 36 and 39 as follows:

Claims 1-13 (Canceled)

1 | 14. (Currently Amended) An approximation system for a series expansion of an
2 input function with a finite number of terms N to minimize an approximation error, said
3 system including an operational processing unit, said operational processing unit
4 comprising:

5 means for expanding ~~an operational processing unit which expands~~ the input
6 function in Taylor series up to an $(N-1)$ -th term to obtain a first expansion result;
7 ~~expands~~

8 means for expanding the input function in Taylor series up to an N -th term to
9 obtain a second expansion result; ~~multiplies~~

10 means for multiplying the first expansion result by a predetermined weight α to
11 obtain a multiplication result; ~~combines~~

12 means for combining the multiplication result and the second expansion result to
13 obtain a combined result; ~~[[,]]~~ and

14 means for dividing ~~divides~~ the combined result by $(\alpha+1)$;

15 whereby to minimize the approximation error.

1 2 15. (Original) The system of claim 14, wherein α is greater than 0 and no greater
2 than 1.

1 3 16. (Original) The system of claim 14, wherein α obtained for a corresponding
2 respective N is selected so as to minimize a maximum approximation error.

1 7 17. (Currently Amended) An approximation system for a series expansion of an
2 input function with a finite number of terms N to minimize an approximation error, said
3 system including an operational processing unit, said operational processing unit
4 comprising:

5 means for expanding ~~an operational processing unit which expands~~ the input
6 function in Taylor series up to an (N-1)-th term to obtain an expansion result; ~~multiplies~~

7 means for multiplying an N-th term of the expansion result by a predetermined
8 weight value to obtain a multiplication result; ~~[[,]]~~ and ~~combines~~

9 means for combining the expansion result and the multiplication result to obtain
10 an approximation function f for the series expansion function;

11 whereby to minimize the approximation error.

1 8 18. (Original) The system of claim 17, wherein the predetermined weight value is

2 $\frac{(-1)^N}{(\alpha + 1)}$ for $0 < \alpha \leq 1$.

1 ⁹ 19. (Original) The system of claim ⁸ 18, wherein α obtained for corresponding
2 respective N is selected to minimize a maximum approximation error.

1 ¹⁰ 20. (Original) The system of claim ⁹ 19, wherein α is obtained by:

2 (a) selecting a minimum input in a given input x area;

3 (b) calculating the approximation function f for the input function with the finite
4 number of terms N

5 (c) obtaining and storing an error $E_{N,x}$ by subtracting approximation function f
6 from a nominal function value of the input x;

7 (d) determining whether the input x has reached a maximum value in the given
8 input x area, adding a predetermined increment ξ to x when x has not yet reached the
9 maximum value, and repeating steps (b), (c) and (d);

10 (e) selecting a maximum error value among all the stored errors $E_{N,x}$ for all inputs
11 when x has reached a maximum value; and

12 (f) searching α to minimize the maximum error value, and storing α as the weight
13 value for a corresponding N.

Claim 21 (Canceled)

1422. (Currently Amended) An orthogonal frequency division multiplexing (OFDM) system for compensating a carrier frequency offset, said system comprising:

an estimator for estimating the carrier frequency offset $\hat{\epsilon}$ by using a series expansion of a function $\arctan(x)$;

a first phase rotation calculator for using the estimated carrier frequency offset to obtain a phase rotation value for a first input sample of $k=1$, wherein $\sin(2\pi\hat{\epsilon})$ and $\cos(2\pi\hat{\epsilon})$ are series-expanded to minimize an approximation error;

a second phase rotation calculator for using a phase rotation value for a previous input sample including $k=1$ to obtain a phase rotation value for a subsequent input sample; and

a compensator for compensating the phase rotation values for all input samples, thereby compensating the carrier frequency offset.

15 23. (Original) The system of claim 22¹⁴, wherein the estimated carrier frequency

offset $\hat{\epsilon}$ is represented by $\hat{\epsilon} = \frac{1}{2\pi} \arctan \left\{ \frac{\sum_{i=1}^L \text{Im}(y(-i)y^*(L-i))}{\sum_{i=1}^L \text{Re}(y(-i)y^*(L-i))} \right\}$, where Re and Im

represent a real part and an imaginary part, respectively, of a complex number, $y(i)$ represents an i -th received sample, L is a fast fourier transformation (FFT) size, and \hat{e} is an estimated and normalized carrier frequency offset of $\Delta \hat{f}T$.

16 24. (Currently Amended) The ~~method~~ ¹⁵ system of claim 23, wherein the phase rotation value for a k -th sample is calculated by:

$$\text{For } k=1, \cos(\Delta \hat{\omega} T_s) = \sum_{n=0}^N (-1)^n \frac{\Delta \hat{\omega} T_s^{2n}}{(2n)!}$$

$$\sin(\Delta \hat{\omega} T_s) = \sum_{n=0}^N (-1)^n \frac{\Delta \hat{\omega} T_s^{(2n+1)}}{(2n+1)!}$$

$$\begin{aligned} \text{For } k \geq 2, \cos(k \Delta \hat{\omega} T_s) &= \cos((k-1) \Delta \hat{\omega} T_s + \Delta \hat{\omega} T_s) \\ &= \cos((k-1) \Delta \hat{\omega} T_s) \cos(\Delta \hat{\omega} T_s) - \sin((k-1) \Delta \hat{\omega} T_s) \sin(\Delta \hat{\omega} T_s) \\ \sin(k \Delta \hat{\omega} T_s) &= \sin((k-1) \Delta \hat{\omega} T_s + \Delta \hat{\omega} T_s) \\ &= \sin((k-1) \Delta \hat{\omega} T_s) \cos(\Delta \hat{\omega} T_s) + \cos((k-1) \Delta \hat{\omega} T_s) \sin(\Delta \hat{\omega} T_s) \end{aligned}$$

17 25. (Currently Amended) The ~~method~~ ¹⁴ system of claim 22, wherein the phase rotation value for a k-th sample is calculated by:

$$\text{For } k=1, \cos(\Delta\hat{\omega}T_s) = \sum_{n=0}^N (-1)^n \frac{\Delta\hat{\omega}T_s^{2n}}{(2n)!}$$

$$\sin(\Delta\hat{\omega}T_s) = \sum_{n=0}^N (-1)^n \frac{\Delta\hat{\omega}T_s^{(2n+1)}}{(2n+1)!}$$

$$\begin{aligned} \text{For } k \geq 2, \cos(k\Delta\hat{\omega}T_s) &= \cos((k-1)\Delta\hat{\omega}T_s + \Delta\hat{\omega}T_s) \\ &= \cos((k-1)\Delta\hat{\omega}T_s) \cos(\Delta\hat{\omega}T_s) - \sin((k-1)\Delta\hat{\omega}T_s) \sin(\Delta\hat{\omega}T_s) \\ \sin(k\Delta\hat{\omega}T_s) &= \sin((k-1)\Delta\hat{\omega}T_s + \Delta\hat{\omega}T_s) \\ &= \sin((k-1)\Delta\hat{\omega}T_s) \cos(\Delta\hat{\omega}T_s) + \cos((k-1)\Delta\hat{\omega}T_s) \sin(\Delta\hat{\omega}T_s) \end{aligned}$$

Claims 26-35 (Canceled)

4 36. (Currently Amended) The system of claim 14, wherein the operational processing unit further comprises:

means for using[[uses]] the approximation to obtain a phase rotation value for a first input sample of k=1, wherein $\sin(2\pi\hat{e})$ and $\cos(2\pi\hat{e})$ are series-expanded to minimize the approximation error;

means for using a phase rotation value for a previous input sample including k=1 to obtain a phase rotation value for a subsequent input sample; and

means for compensating the phase rotation values for all input samples.

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1 37. (Previously Presented) The system of claim 36, wherein an estimated carrier

2 frequency effect $\hat{\epsilon}$ is represented by $\hat{\epsilon} = \frac{1}{2\pi} \arctan \left\{ \frac{\sum_{i=1}^L \text{Im}(y(-i)y^*(L-i))}{\sum_{i=1}^L \text{Re}(y(-i)y^*(L-i))} \right\}$, where Re and Im

3 represent a real part and an imaginary part, respectively, of a complex number, $y(i)$
4 represents an i-th received sample, L is a fast fourier transformation (FFT) size, and $\hat{\epsilon}$ is
5 an estimated and normalized carrier frequency offset of $\Delta f T$.

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1 38. (Previously Presented) The system of claim 37, wherein the phase rotation
2 value for a k-th sample is calculated by:

$$\text{For } k=1, \cos(\Delta \hat{\omega} T_s) = \sum_{n=0}^N (-1)^n \frac{\Delta \hat{\omega} T_s^{2n}}{(2n)!}$$

$$\sin(\Delta \hat{\omega} T_s) = \sum_{n=0}^N (-1)^n \frac{\Delta \hat{\omega} T_s^{(2n+1)}}{(2n+1)!}$$

$$\begin{aligned} \text{For } k \geq 2, \cos(k \Delta \hat{\omega} T_s) &= \cos((k-1) \Delta \hat{\omega} T_s + \Delta \hat{\omega} T_s) \\ &= \cos((k-1) \Delta \hat{\omega} T_s) \cos(\Delta \hat{\omega} T_s) - \sin((k-1) \Delta \hat{\omega} T_s) \sin(\Delta \hat{\omega} T_s) \\ \sin(k \Delta \hat{\omega} T_s) &= \sin((k-1) \Delta \hat{\omega} T_s + \Delta \hat{\omega} T_s) \\ &= \sin((k-1) \Delta \hat{\omega} T_s) \cos(\Delta \hat{\omega} T_s) + \cos((k-1) \Delta \hat{\omega} T_s) \sin(\Delta \hat{\omega} T_s) \end{aligned}$$

11 39. (Currently Amended) The system of claim 17, said operational processing unit further comprising ~~the steps of~~:

means for using the approximation to obtain a phase rotation value for a first input sample of $k=1$, wherein $\sin(2\pi \hat{e})$ and $\cos(2\pi \hat{e})$ are series-expanded to minimize the approximation error;

means for using a phase rotation value for a previous input sample including $k=1$ to obtain a phase rotation value for a subsequent input sample; and

means for compensating the phase rotation values for all input samples.

12 40. (Previously Presented) The system of claim 39, wherein an estimated carrier

frequency effect \hat{e} is represented by
$$\hat{e} = \frac{1}{2\pi} \arctan \left\{ \frac{\sum_{i=1}^L \text{Im}(y(-i)y^*(L-i))}{\sum_{i=1}^L \text{Re}(y(-i)y^*(L-i))} \right\},$$
 where Re

and Im represent a real part and an imaginary part, respectively, of a complex number, $y(i)$ represents an i -th received sample, L is a fast fourier transformation (FFT) size, and \hat{e} is an estimated and normalized carrier frequency offset of $\Delta f T$.

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41. (Previously Presented) The system of claim 40, wherein the phase rotation value for a k-th sample is calculated by:

$$\text{For } k=1, \cos(\Delta\hat{\omega}T_s) = \sum_{n=0}^N (-1)^n \frac{\Delta\hat{\omega}T_s^{2n}}{(2n)!}$$

$$\sin(\Delta\hat{\omega}T_s) = \sum_{n=0}^N (-1)^n \frac{\Delta\hat{\omega}T_s^{(2n+1)}}{(2n+1)!}$$

$$\begin{aligned} \text{For } k \geq 2, \cos(k\Delta\hat{\omega}T_s) &= \cos((k-1)\Delta\hat{\omega}T_s + \Delta\hat{\omega}T_s) \\ &= \cos((k-1)\Delta\hat{\omega}T_s) \cos(\Delta\hat{\omega}T_s) - \sin((k-1)\Delta\hat{\omega}T_s) \sin(\Delta\hat{\omega}T_s) \\ \sin(k\Delta\hat{\omega}T_s) &= \sin((k-1)\Delta\hat{\omega}T_s + \Delta\hat{\omega}T_s) \\ &= \sin((k-1)\Delta\hat{\omega}T_s) \cos(\Delta\hat{\omega}T_s) + \cos((k-1)\Delta\hat{\omega}T_s) \sin(\Delta\hat{\omega}T_s) \end{aligned}$$